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ORTHOTRICHUM.

By A. J. Grout.

Family Orthotrichaceæ.

Plants usually growing in short dense cushions on rocks or trees blackish or brownish green, at least below. Leaves oblong-lanceolate or linear-lanceolate, usually very hygroscopic; cells of the upper part, at least, more or less rounded-hexagonal, often papillose. Capsule often immersed. Calyptra often hairy. Peristome double or single, rarely absent, the teeth often united in pairs. This family is usually united with the Grimmiaceae on account of similar habit and facies, but the peristome characters are so different as to fully warrant its separation. A general idea of these peristomial differences is best obtained by an inspection of the illustrations.

Orthotrichum Hedw.

Plants comparatively short stemmed, in close rounded cushions, sometimes looser, on trees everywhere, and more rarely on rocks. Leaves very hygroscopic, imbricated when dry and not appreciably curled or twisted, which character separates the genus from *Weissia* except *W. Americana.* Upper leaf cells usually papillose, thick-walled, the lower thinner-walled and quadrate to rectangular. Calyptra sparsely hairy or naked. Base of seta enclosed in a minute cup-like sheath, the ochrea. Capsule immersed or emergent rarely exserted; usually with 8 regular folds or plicae when dry, but sometimes smooth or with 16 plicae. Peristome usually double with 16 broadly lanceolate teeth, which are usually united in pairs. Inner peristome of 8–16 narrow segments, often called cilia. The paired (bigeminate) teeth and degenerate inner peristome illustrate well the degeneracy of peristomes on erect capsules.

A difficult genus. usually avoided by the amateur, but I believe one can learn to recognize all the common species with a hand lens when they are well fruited. It will usually serve to determine the number and position of the teeth, markings of the capsules and general outlines of the leaves. Sterile specimens are often indeterminable. The stomata furnish an excellent and definite character and are easily observed by separating a capsule into two or more divisions with the dissecting needles and mounting outside up; the stomata are nearer the middle of the capsule than in many mosses and are, therefore, easier of observation. The condition of the material is of the utmost importance. The capsule must be thoroughly soaked in hot water for a long time to be fully expanded, and the dry capsule must be thoroughly dry to be characteristic. The capsules of all species shrink progressively with increasing age, and many varieties had their origin in this fact. The plants should be moistened to determine whether the capsules are immersed, emergent, or exserted.

Key.

1. Rock-inhabiting species; peristome single, teeth 16, erect or erect-spreading on dry capsules. ....2.
   Tree-inhabiting species; peristome double, teeth usually united into 8 pairs, recurved or reflexed when dry ....4.

2. Capsule fully exserted, 16-striate .... *anomalum.*
   Capsule emersed or emergent, 8-striate ....3.
3. Capsule ovate-cylindric, urn half emergent when dry...*Porteri.*
   Capsule much shorter, ovate-globose, leaves nearly reaching mouth of urn when dry............................*Lescurii.*
4. Stomata superficial (*i. e.*, with both guard cells on the surface. See Plate VI, Figure 13).............................5.
   Stomata immersed. (See Figure I, 10)..... ....8.
5. Leaves obtuse (rarely with some leaves acute), broad pointed, margins plane.......................*obtusifolium.*
   Leaves acute, margins revolute or involute...................6.
6. Capsule almost or quite exserted, smooth, or very slightly plicate around the mouth when dry and empty....*speciosum.*
   Capsules immersed or slightly emergent, plicate the whole length when dry...... ....7.
7. Empty capsule strongly contracted below the mouth when dry, neck immersed; common... ....*sordidum.*
   Empty capsule less strongly contracted, exserted; rare.....*affine.*
8. Capsules strongly contracted under the mouth when dry, and so strongly plicate that the red-brown folds are in contact on the outside when dry and empty...*strangulatum.*
   Capsules very slightly or not at all contracted, much less strongly plicate, pale, whitish or yellowish................9.
9. Leaves entire, blunt at extreme apex.................*Ohioense.*
   Leaves (some at least) dentate, with projecting cells, often apiculate............................ ....10.
10. Leaves mostly acute at apex, not rounded; usually some with an apiculus of a single projecting cell, capsules plainly 8 plicate when dry..................................*Schimperi.*
    Leaves obtuse, rounded at apex and some sharply denticulated at apex with several projecting cells, capsule smooth or faintly 8 plicate when dry.......... ....*pusillum.*

O. ANOMALUM Hedw. Plate II. In rather dense cushions, dark olive green or brown below; leaves ovate-lanceolate, papillose with small simple papillae; calyptra hairy; capsule usually fully exserted, 16-striate, the 8 intermediate folds less distinct, oval-cylindric when moist, cylindric when dry, abruptly narrowed to the neck: peristome erect when dry, of 16 teeth, usually separate, with preperistome (*i. e.*, with two short lamellae before each tooth reaching as high as the second or third articulation); segments none or rudimentary. Spores maturing May-June. Not rare.

Mrs. Britton says that we also have the var. *saxatile*, which has narrower 8-striate capsules with teeth united in pairs, and 8 well developed segments.

This species will not be confused with any other species of *Orthotrichum*, but may be confused with *Weissia Americana.* The latter has the dry capsule gradually narrowed into the long neck and the teeth *reflexed* when dry; besides it is almost black in color except at the extreme ends of the stems and branches, and grows in loose wide mats. Its spores mature much later, July-September. Drummondia has the general appearance of an Orthotrichum with an exserted capsule, but it grows on trees only.

O. PORTERI Aust. and O. LESCURII Aust. are our only other rock-inhabiting forms, at least the only ones at all likely to be met with. They have usually been treated as varieties of *O. cupulatum* Hoffm., but both Dr.

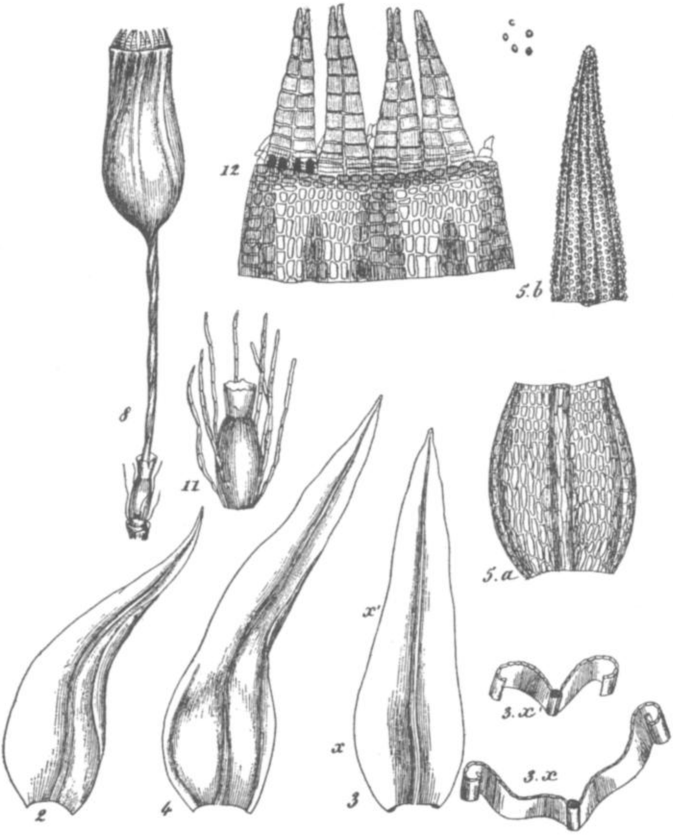

PLATE II.—*Orthotricum anomalum* (Bry. Eur. Pl. 210).

Figs. 2, 3, 4 and 5—Leaves; *x* and *x′* indicate where the sections *3x* and *3x′* were made. Fig. 11—Vaginula. Fig. 8—Deoperculate capsule and seta. Fig. 12—Peristome highly magnified; the tooth at the left has been redrawn to show the lamellae of the preperistome.

Venturi and Mrs. Britton consider them distinct, and Mrs. Britton says that we have no *capulatum* in the Eastern States. These two forms have not been frequently collected or adequately described. Their habitat and immersed or emergent capsules should serve to identify them and collectors should be on the lookout for them.

Dr. Venturi stated in a letter to Mrs. Britton that *O. Porteri* had a distinct preperistome as in *O. anomalum*, but he is the only one who has noted it, and other observers have failed in their attempts to verify his observations.

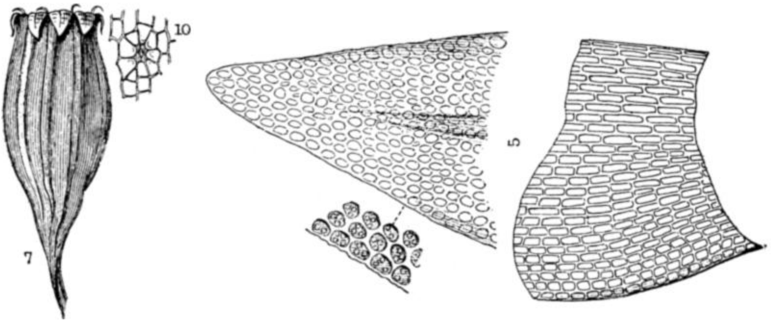

FIG. I.—*O. Ohioense* (Icones Musc. Suppl Pl. 48).

Fig. 7—Dry and empty capsule. Fig. 10—Stoma. Fig. 5—Areolation of leaf.

O. OHIOENSE S. & L. Figure I. In rather dense, small cushions, yellowish green, brown below; stems about 1 cm long; leaves oblong-lanceolate, blunt at the apex or obtusely acute, papillose; calyptra hairy; moist capsule immersed, oblong-ovate, when dry slightly 8-plicate, campanulate, becoming more narrowed with age, straw colored; peristome of 8 double teeth, strongly reflexed when dry; segments shorter than the teeth, of a double row of cells, except at apex; spores maturing in early spring (April) Common on trees. When sterile it is a difficult matter to distinguish this from the next, but the straw-colored lightly-plicate capsules are easy of recognition and the entire leaves serve to distinguish it from the other species with light-colored capsules.

O. STRANGULATUM Sulliv. Figure II. This is one of our commonest mosses, abundant on shade trees almost everywhere. It can be recognized with a hand lens by the characters given in the key if one is familiar with it. The capsules are not so deeply plicate until a month or more after the spores ripen. It is a little smaller than the preceding, the leaves are narrower, and the calyptra naked; the spores apparently mature about a month later. The first few rows of cells around the mouth of the capsule in this species have nearly quadrate cavities, while in the preceding these cavities are nearly circular.

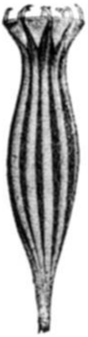

FIG. II.
Capsule of
O. strangulatum.

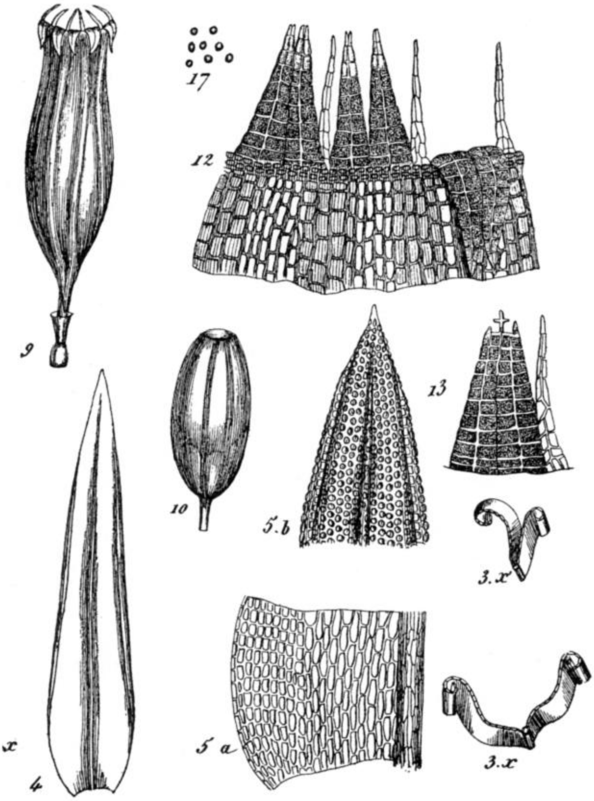

PLATE III.—*O. Schimperi* (Bry. Eur. Pl. 211).
Figs. 3, 4 and 5—Leaves. Figs. 9, 10, 12 and 13—Capsules and peristome

O. SCHIMPERI Hamm. (*O. fallax* Schimp) Plate III. In short, close, dark green tufts, only a few mm. high; leaves oblong-lanceolate, obtuse or usually some acute and ending in an apiculus of a single elongated cell, leaf cells rather large and thinner-walled than usual in the genus, papillose; calyptra with a few short hairs; capsule small, immersed oblong-ovoid, light colored, when dry narrow and slightly contracted below the mouth, with 8 rather prominent plicae; teeth 8, reflexed, densely papillose; segments 8; spores maturing in spring, Frequent.

A specimen with all the leaves obtuse might be mistaken for *O. Ohioense*, but the smaller size and darker color and smoother calyptra are quite pronounced. The form with the leaves narrowly acute and apiculate and narrower capsule has been called var. *truncatulum* by Austin. Rarely the leaves have more than a single projecting cell at the apex. Mrs. Britton and Dr. Best think that *O. brachytrichum* Schimp. is a synonym for the American form of this species, and that we have no true *O. Schimperi.*

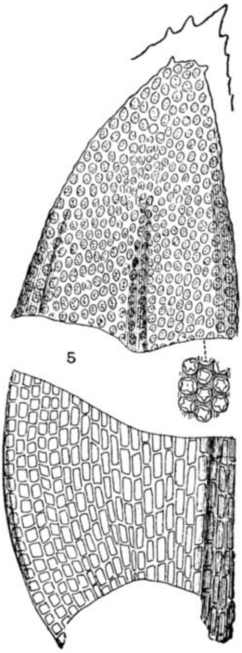

FIG. III.
Leaf structure of
O. pusillum
(Icon. Musc. Suppl.
Pl. 50).

O. PUSILLUM Mitt. (*O. psilocarpum* James.) Figure III. The plants are as small as those of the preceding and the color is blackish green, but the capsules are ovoid or globose when moist, only faintly ribbed even when old. Spores maturing in May. Apparently not common. The apex of the leaves is very characteristic as figured. It is very like *O. Schimperi* except in the characters mentioned here and in the key.

O. OBTUSIFOLIUM Schrad. Plate IV. Yellowish-green, about an inch high; leaves short and very broad, oblong-ovate, *very broad and obtuse at apex, papillose, margin not appreciably revolute or incurved:* calyptra naked; capsule immersed, with 8 plicae when dry: peristome double.

Probably a very common species, but so seldom fruiting as to be collected infrequently. The leaves usually bear clavate, septate gemmae, which may account for the rarity of the fruit. The broad apex, entire except for papillae, and erect margins, render sterile specimens easy to determine. All other species have the margins revolute or involute. *O. gymnostomum* Bruch has been found in Newfoundland. It is closely related to this species but has *involute* leaves and no peristome. Collectors should look out for it.

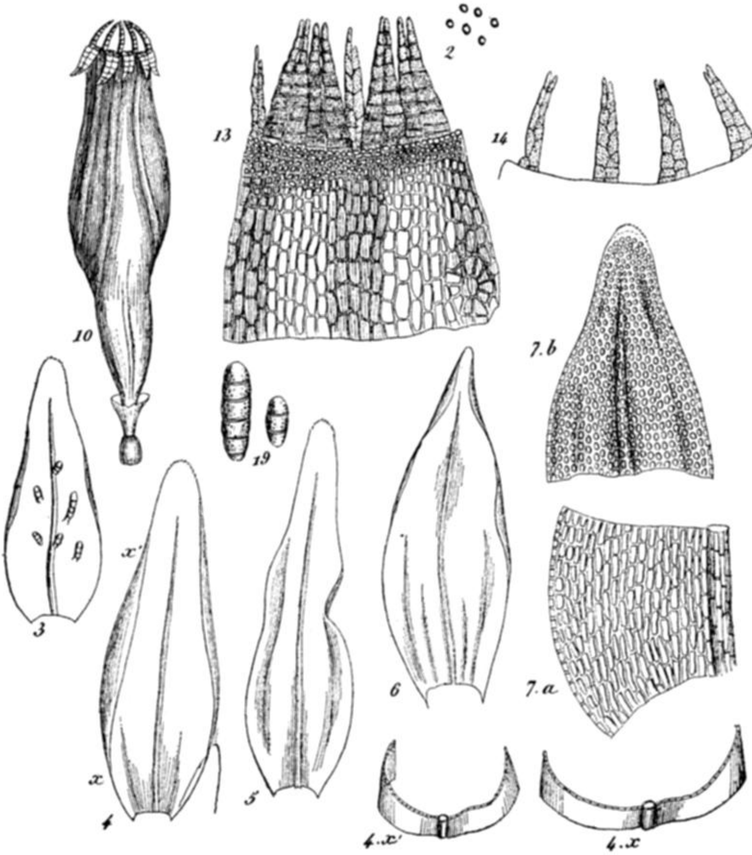

PLATE IV.—*O. obtusifolium* (Bry. Eur. Pl. 208).

Figs. 3, 4, 5 and 6—Leaves from below upwards. Fig. 7—Showing cellular structure. Fig. 10—Capsule. Fig. 13—Peristome highly magnified. Fig. 14—Segments of the same. Fig. 19—Propagula.

O. SPECIOSUM Nees. Plate V. Perhaps the largest of our species, an inch to an inch and a half in height, yellow-green above: leaves tapering, *very acute,* papillose; *leaf cells very thick walled,* the upper circular or elliptical; calyptra large, hairy, companulate; capsule oblong-cylindrical, almost exserted, the upper leaves barely reaching the base, smooth or barely marked with irregular ridges when dry; operculum rostellate; peristome of 8 teeth, which when dry are recurved rather than reflexed, as the tip of the tooth sometimes touches the capsule wall in a way to remind one of the handle of a mug; segments 8, papillose. Like *O. obtusifolium,* this species rarely occurs on rocks. The spores mature by October, but I have collected operculate capsules in March.

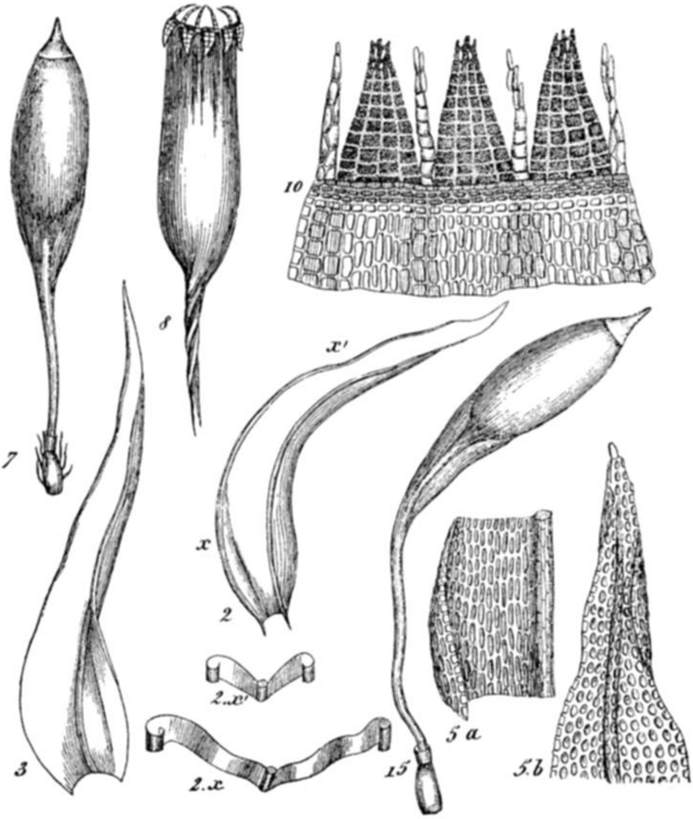

PLATE V.—*O. speciosum* (Bry. Eur. Pl. 217).
Figs. 2, 3 and 5—Leaves. Figs. 7, 8, 10 and 15—Capsules and peristome.

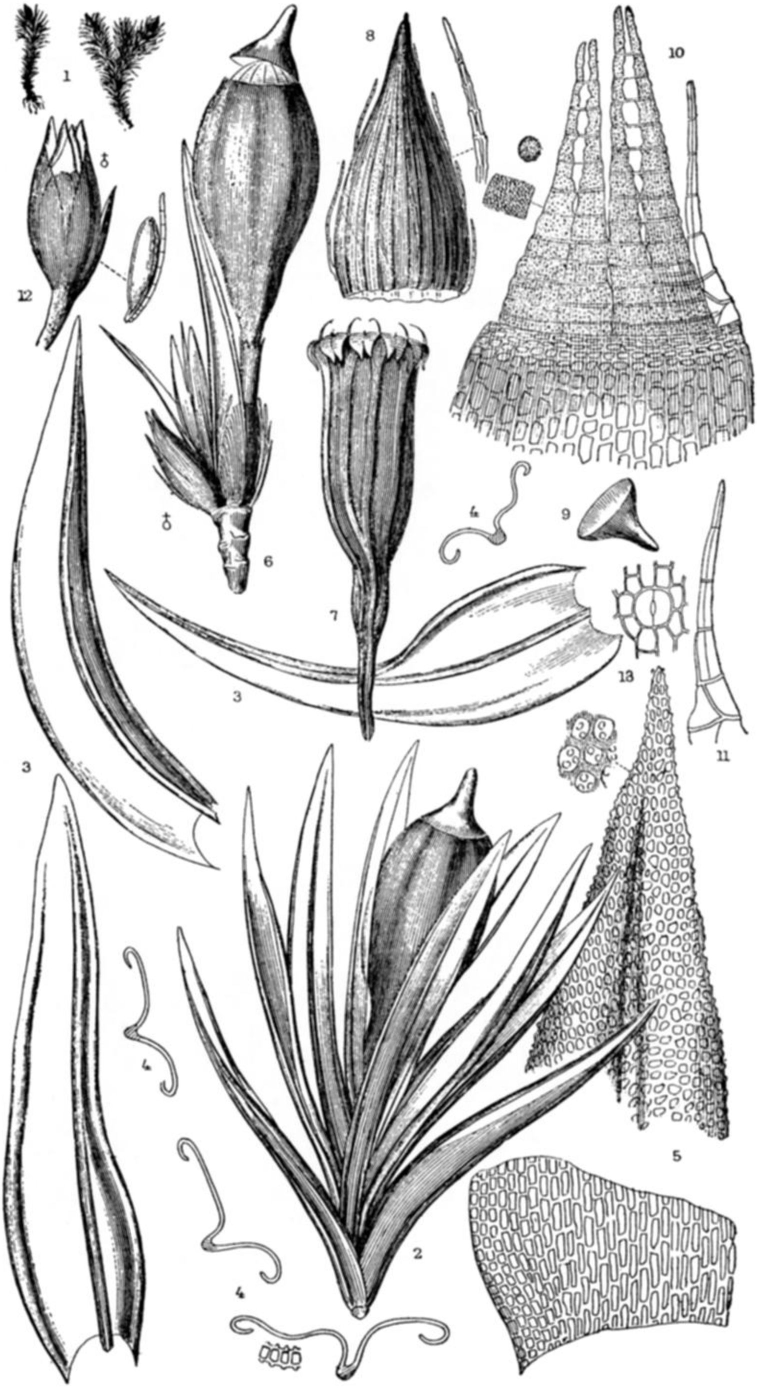

Plate VI.—*O. sordidum* (Icones Musc. Suppl. Pl. 49).

O. SORDIDUM S & L. Plate VI. Somewhat resembles the preceding in leaf characters, but the leaves, though acute, are broader pointed with thinner cell walls. It is at once distinguished by the immersed or emergent plicate capsules and smooth segments. The spores mature in late spring or summer.

This species is so close to the var. *fastigiatum* of *O. affine* that it may cause confusion, especially as the the teeth of *sordidum* are often as markedly trabeculate at the summit as those of *fastigiatum* figured by Limpricht (Laubmoose **2**:82), but both *affine* and its var. are rare. I have not been able clearly to differentiate *sordidum* from *affine*, and incline to the opinion that they are forms of the same species for all except the experts. All our ordinary forms are *sordidum*, however. *O. affine*, is certainly treated differently by European authors and is exceedingly variable. The capsule of *sordidum* is often so strongly contracted under the mouth as to resemble *strangulatum* except for the larger size of the plant and the lighter color of the capsule.

O. *striatum* (L.) Hedw. (*O. leiocarpum* B. & S.) is a rare species, with capsule almost as smooth as in *O. speciosum*, and it has been confused with it by several good bryologists, but the capsules are *immersed* or only slightly emergent and ovoid; teeth *16*, *separate*, and 16 comparatively broad segments.

In August I have found *O. speciosum*, *O. sordidum*, *O. strangulatum*, and *O. Ohioense* growing together on fruit trees. *O. strangulatum* is much the the most abundant, and is easily recognized by the strangulate, dark red-brown capsules appearing as described in the text. *O. Ohioense* is about the same size, but the straw-colored capsules catch the eye at once. *O. sordidum* stands out at once by reason of its greater size and larger leaves and capsules less plicate than in *O. strangulatum*. *O. speciosum* is somewhat smaller than *sordidum*, and at this time the capsules are immature with the hairy calyptra still firmly attached. The comparative sizes of *speciosum* and *sordidum* is just the reverse of what my herbarium specimens and the book descriptions lead me to expect, as the specimens of *speciosum* I collected were much smaller than those in my collection.

I desire to acknowledge my indebtedness to Dr. G. N. Best for notes and specimens, and to Mrs. Britton's published notes on this genus.

This monograph is taken from the MS. of a new moss book now in preparation by the writer. I should be very glad to receive criticisms from any one who may have occasion to use it, to the end that I may succeed in making as helpful a book as possible.

A. J. G.

DESCRIPTION OF PLATE VI.

Fig. 1—Plants natural size. Fig. 3—Leaves. Fig. 4—Leaf sections. Fig. 5—Cellular structure of leaf base and apex. Fig. 12—Antheridial branch with antheridium and paraphysis. Fig. 11—Segment of peristome highly magnified. Fig. 13—Superficial stoma. The other figures are self explanatory.